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54. Cleaning Tool for Teeth

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Description

The invention concerns a dental cleaning tool according to the preamble of Claim 1.

This type of cleaning tool is already known from EP 0 354 352 A1. This cleaning tool has a thin shaft provided with an abrasive layer to remove plaque. The shaft can be attached to a handle by means of a mounting device. One problem concerning this known cleaning tool is that effective cleaning of the spaces between the teeth is only possible when these roughly correspond in dimensions to the diameter of the cleaning tool. Moreover, this manually guided and operated cleaning tool is difficult and intricate to handle with respect to insertion into the spaces between teeth and also with respect to the need to move the cleaning tool by the hand of the user.

The task of the invention is to devise a cleaning tool with which effective cleaning, especially of the spaces between teeth, and easy handling is guaranteed.

According to the invention, this task is essentially solved in that the free end section of the shaft has a roughly crescent-shaped bent section.

According to the invention, the cleaning tool has the beneficial advantage of effective teeth-cleaning and easy handling. Simple insertion of the cleaning tool into the spaces between teeth is guaranteed, owing to the fact that the cleaning tool can be coupled to an electric motor drive and placed in rotation or oscillation around a shaft longitudinal center axis. Due to the problem-free motorized movement of the cleaning tool, nonfatiguing and effective cleaning of the teeth is also guaranteed. The cleaning tool is automatically adapted to the individual sizes of spaces between teeth, owing to the fact that the free end section of the shaft consists of a flexible material and has a roughly crescent-shaped bent section. During rotation and oscillation of the cleaning tool around the longitudinal center axis of the shaft, the roughly crescent-shaped bent section describes a roughly barrel-shaped outer surface. Owing to the flexibility of the end section of the shaft, the diameter of this outer surface is automatically adjusted to the individual dimensions of the individual spaces between teeth. According to the invention, in each case, spaces between teeth of different dimensions can be effectively cleaned with the cleaning tool. Subsequently, the free end section comes in contact with the tooth side surfaces in the region of the roughly crescent-shaped bent section, even in spaces between teeth of different width.

An essentially straight insertion section, whose shaft longitudinal center axis is identical to the axis of rotation, is advantageously connected at the head end to the bent part of the end section.

Insertion of the cleaning tool into the spaces between teeth is substantially simplified due to this.

The length of the bent part is advantageously in a ratio of about 1:2 to the length of the end section. A favorable compromise between optimal insertion of the cleaning tool and effective tooth cleaning is achieved by these dimensions.

According to an advantageous embodiment, the free end section has two adjacent bent parts forming an eyelet. Due to this flexible cleaning eyelet, the cleaning tool can automatically adjust to different spaces between teeth. During this stage weight equalization is created through the arrangement of two adjacent bent parts relative to each other. At this time the cleaning tool does not undergo significant excursion because of imbalance under the influence of high rotational or oscillation speed. On the other hand, the cleaning effect of the cleaning tool is improved by the use of two bent parts in individual cases. Owing to the flexibility of the end section, the cleaning eyelet is also adjusted to the different dimensions of the spaces between teeth automatically. In this and also the previously mentioned variants, cleaning of the toothÕs external and internal surfaces is naturally also possible, during which the cleaning tool is guided tangentially on these surfaces.

The free end section advantageously consists of a polyester-containing plastic, especially Hytrel. Such plastics have high alternating bending endurance, so that high and uniform spring action of the bent part or eyelet is achieved. Due to this choice of material, bending of the entire cleaning shaft and a rotational or oscillatory drive of the cleaning shaft around the shaft longitudinal center axis is possible.

An intermediate section with one or more spherical enlargements is advantageously arranged between the end section and the mounting section. The torsional strength of the shaft of the cleaning tool is increased by these spherical enlargements in the intermediate section, which leads to lengthening of the lifetime of the cleaning tool.

According to one practical example of the invention, the free end section has at least one blade-like cleaning edge running essentially parallel to the shaft longitudinal center axis. Loosening, especially of adherent tooth coatings, like plaque, is further improved by means of this cleaning edge.

An advantageous variant of the cleaning tool consists of the fact that the free end section has a length of about 5 mm, a thickness of about 0.3 mm and a bent section of about 0.5 mm or an

eyelet with a free width of about 1 mm.

According to a particularly advantageous independent embodiment of the invention, the cleaning tool is enclosed by a receiving sleeve. The cleaning tool is protected by the sleeve from soiling as well as damage when not in use and can be easily transported in luggage.

Easy handling of the cleaning tool is guaranteed owing to the fact that the cleaning tool is mounted in order to shift in the completely enclosed receiving sleeve. The cleaning tool can be moved from a storage position to a working position. During which the free end section protrudes from the receiving sleeve.

When not in use, the cleaning tool is protected in the receiving sleeve and can be pushed out simply from the receiving sleeve for use and for insertion into the spaces between teeth.

The receiving sleeve advantageously has a hollow, cylindrical coupling section. A guide sleeve is connected at this section, wherein the intermediate section and, optionally, depending on the position of the cleaning tool, the end section of the cleaning tool are guided. By means of the guide sleeve, the user can easily feel the spaces between teeth and, after correct positioning, push out the cleaning tool for use from the receiving sleeve. Due to this, the cleaning tool can penetrate with the free end section into the spaces between teeth in order to clean.

The expedient of the inside diameter of the guide sleeve for the cleaning tool is only slightly larger than the diameter of the spherical enlargements of the intermediate section which is of particular advantage. The spherical enlargements, which are advantageously distributed uniformly over the length of the shaft, act as bearings in the guide sleeve and thus reduce sliding friction, since only linear contact is present between the spherical enlargements and the inside wall of the guide sleeve. This means that torsional stresses in the shaft of the cleaning tool during use are substantially reduced and the lifetime of the cleaning tool, consisting of a plastic with alternating bending endurance, is thus increased.

According to one embodiment of the invention, the guide sleeve has an essentially circular arc-shaped bent part, in which the arc spans an angular range between 30 degrees and 150 degrees, preferably 90 degrees $\pm$ 20 degrees. By this expedient, use of the dental cleaning tool, especially to feel the spaces between teeth and for insertion of the free end section and also subsequent cleaning, is facilitated.

According to another embodiment of the invention, the cleaning tool can be used with the receiving sleeve as a replacement part, which can be replaced when worn. For replacement, the receiving sleeve, with the cleaning tool fully accommodated in it, is simply removed from the handle and replaced with a new cleaning tool with receiving sleeve. Owing to the fact that the cleaning tool is completely removed from the receiving sleeve, the user cannot come in contact with the soiled cleaning tool during the replacement process.

According to a particularly advantageous, independent embodiment of the invention, the cleaning tool is attached by means of detents in a transport position in the receiving sleeve. The cleaning tool can be transferred by connection to the drive of the handle from the transport position into the storage position or, optionally, the working position. Owing to the fact that the cleaning tool can be releasably attached within the receiving sleeve in a transport position, in which the cleaning tool is fully enclosed by the receiving sleeve, damage to the cleaning tool is avoided up to its first use. Packaging for the replacement part can therefore be of uncomplicated design.

The cleaning tool is advantageously connectable to an electric motor drive of a handle, in which the drive shaft of the handle can be connected to rotate in unison with the cleaning tool and is mounted to move in the longitudinal direction of the handle. The cleaning tool can therefore be transferred from the rest position to the working position by simple movement of the drive shaft in the longitudinal direction of the handle.

The cleaning tool can be transferred in the on state to a preset position owing to the fact that the drive shaft is connected to a switch for engagement and disengagement of the electric motor drive. On the one hand, movement of the switch, causes engagement of the electric motor drive and, on the other hand, accompanying automatic transfer of the cleaning tool from the rest position to the working position. This expedient has the advantage that the user can easily insert the cleaning tool into the spaces between teeth, in which this process is further supported by the rotating or oscillating movement of the cleaning tool. For disengagement, the switch is returned to the off position, in which the electric motor drive is switched off and the cleaning tool is simultaneously refracted into the receiving sleeve.

According to an advantageous modification of the invention, the drive shaft is acted upon by restoring devices that automatically transfer the drive into the off position and/or the drive shaft into the retracted position during incorrect activation of the switch. This guarantees that the tooth-cleaning device is always automatically switched to the off position when the user releases the switch. The spring then causes immediate disengagement of the electric motor drive and, at

the same time, retraction of the cleaning tool into the receiving sleeve. Possible damage from incorrect handling of the cleaning tool is largely avoided because of this. Moreover, it is guaranteed that the cleaning tool is only out of the receiving sleeve during the actual cleaning phase, but otherwise positioned protected within the receiving sleeve because of the effect of the restoring device.

Additional features, advantages and application possibilities of the invention are apparent from the following description of practical examples that are further shown in the drawing.

In the drawing:

Figure 1 shows a partially cut schematic view of a practical example of a dental cleaning device with the cleaning tool according to the invention in a side view,

Figures 2, 3 show two variants of the cleaning tool according to the invention,

Figures 4, 5 show a schematic view of the cleaning tool according to the invention with the receiving sleeve, in which the cleaning tool is in the transport and working position,

Figure 6 shows an enlarged perspective view of the shaft of the cleaning tool according to the practical example of Figure 2, and

Figures 7, 8 show a cross section of planes VII and VIII of the cleaning shaft of Figure 6.

The dental cleaning device 1, consisting of a handle part 2 and a mounting part 3, is shown in Figure 1. The handle part 2 is designed elongated and has an essentially circular cross section. The diameter of the handle part 2 in an intermediate piece 4 facing the mounting part 3 is less than in a handpiece 5 facing away from mounting part 3. The mounting part 3 is also designed essentially elongated and has an essentially circular cross section. The diameter of a coupling section 137 of mounting part 3 facing handle part 2 corresponds to the diameter of the intermediate piece 4 of handle part 2. A guide sleeve 7 of mounting part 3 facing away from handle part 2 has a smaller diameter and is provided with a bent part 8. In the handpiece 5 of handle part 2 an electrically driven motor 9 is accommodated fixed, which is connected via electrical lines 10, 11 to a current source 12, for example, a battery. A switch 13 that can be moved in the longitudinal direction is arranged in handpiece 5. An electrically conducting contact 14 is provided on switch 13, which is

connected via electrical line 11 to current source 12. Moreover, a coupling element 15, which serves for connection of the switch 13 to a drive shaft 16, is arranged on switch 13.

The drive shaft 16 extends through the entire intermediate piece 4 into the handpiece 5 and is designed in the region of handle part 2 as a pot-like receptacle 17 with an opening 18 on the free end facing motor 9. The motor 9, the drive shaft 16 and the pot-like receptacle 17 are arranged concentrically to a common axis 19, in which the opening 18 of the pot-like receptacle 17 faces motor 9. Two spaced annular strips 20, 21 protrude in the radial direction outward from the outside of the pot-like receptacle 17, forming an annular groove 22, into which an annular strip 23 directed inward from coupling element 15 engages. Because of this, shifting of switch 13 in the longitudinal direction leads not only to engagement/disengagement of the device, but also to shifting of the pot-like receptacle 17, together with drive shaft 16 in the longitudinal direction of axis 19. The annular strip 23 is fixed in the peripheral direction, whereas the pot-like receptacle 17 with annular groove 22 can rotate around annular strip 23.

The pot-like receptacle 17 can therefore rotate around axis 19 independently of the position of switch 13. It is understood that in the region of annular strip 23 and the connected annular groove 22 a bearing or similar device can additionally be provided (not shown), in order to reduce friction.

A motor shaft 24 protrudes from motor 9 on the side facing the opening 18 of the pot-like receptacle 17, which is arranged, like motor 9, concentric to axis 19. The motor shaft 24 is provided with at least one, but preferably with several, blades 25 that protrude radially outward. The pot-like receptacle 17 has a corresponding number of longitudinal studs 26 in its internal space, which protrude radially inward. The blades 25 protrude through opening 18 into the internal space of the pot-like receptacle 17 and engage between longitudinal studs 26. The blades 25 and the longitudinal studs 26 then overlap on an axial length that is greater than the maximum length, over which the switch 13 can be moved in the longitudinal direction.

Rotation or oscillation of motor shaft 24 is therefore transferred via blades 25 and longitudinal studs 26 to the pot-like receptacle 17 and drive shaft 16. By overlapping of blades 25 and longitudinal studs 26 in the longitudinal direction, the receptacle 17 can be pushed by switch 13 without separation of the drive connection between motor shaft 24 and drive shaft 16. For example, it is understood that this design feature of the coupling can also be achieved in a different way, by a corresponding gear train or the like. A spring 27, which is fastened in its position by means of support walls 28, 29, is arranged between the side of annular strip 20 facing

the intermediate piece 4 of handle part 2 and the transitional region between handpiece 5 and the intermediate piece 4. The spring 27 creates a force that is directed against movement of switch 13 in the direction toward mounting part 3. This means that the switch 13 and thus drive shaft 16 are forced without external force always automatically in the direction facing away from mounting part 3 into a storage position 40.

The drive shaft 16 is guided by an annular strip 30 protruding inward from handle part 2 on the end of handle part 2 facing mounting part 3. The drive shaft 16 extends slightly from intermediate piece 4 and is provided on its free end with a hole 31 that is arranged essentially concentric to axis 19.

A cleaning tool 101, moveable in the longitudinal direction, is accommodated in the mounting part 3 mounted on handle part 2. The cleaning tool 101 has a cleaning shaft 102, which is designed elongated and thin. The cleaning shaft 102 is preferably about 30 mm long and has a diameter of about 0.3 mm to 0.5 mm. Cleaning shaft 102 is made from a plastic, especially a polyester elastomer, for example, Hytrel. The cleaning shaft 102 is flexible and also permits bending by an angle of up to 150 degrees and more during rotation around its longitudinal axis.

The cleaning tool 101 has a circular base 128 on the end facing drive shaft 16, which is connected to cleaning shaft 102. A pin 129 is connected to base 128. The pin 129 is allocated to the hole 31 of drive shaft 16. The pin 129 and hole 31 can form a press-fit or be adapted to each other in cross sectional shape and, for example, have the shape of a polygon or the like. The pin 129 is inserted to rotate in unison in hole 31, during which the cleaning shaft 102 extends to the guide sleeve 7 and is pushed through this.

Owing to the bent part 8 of guide sleeve 7, the cleaning shaft 102 received in the guide sleeve 7 also has a corresponding bent part 36. The bent part can assume values of up to 150 degrees and more, preferably an angle of 90 degrees $\pm$ 20 degrees is prescribed. The free end of the guide sleeve 7 is provided with an essentially semicircular rounding 37, in which the diameter assumes a value in the range from about 1 mm to 4 mm, especially 2.5 mm. The depicted tooth cleaning device 1 is switchable into a disengaged state with a storage position 40 of cleaning tool 1 and into an engaged state with a working position 41 of cleaning tool 101. The two positions 40, 41 are shown together in Figure 1 with solid or dashed lines. However, the drive shaft 16, as well as the rest of the tooth-cleaning device, are shown uniformly in the storage position 40.

Figure 4 shows the cleaning tool 101 and the corresponding receiving sleeve 136 enlarged. The

storage position 40 of the cleaning tool 101 is depicted with a dashed line and the working position 41 with a solid line. In the storage position 40, the cleaning tool 101, and especially the cleaning shaft 102, are arranged fully within the receiving sleeve 136 or the mounting part 3. The base 128 and the pin 129 are situated in the immediate vicinity of the end of handle part 2 facing mounting part 3. In contrast, in the working position 41, the cleaning tool 101 is not fully received by the receiving sleeve 136. The end section 105 of the cleaning shaft 102 protrudes from the free end of the guide sleeve 7. The length of the end section 105 is preferably about 10 mm to about 15 mm, especially 12 mm.

If the switch 13 is in the off position, the contact 14 has no connection to the connection contact of motor 9. The motor shaft 24, as well as the drive shaft 16 and cleaning tool 101, then do not rotate or oscillate. The drive shaft 16 is also situated in the retracted position depicted in Figure 1 because of the force exerted by spring 27. This means that the cleaning tool 101 is also situated in the storage position 40 and is fully enclosed by the mounting part 3. If the user shifts the switch 13 in the longitudinal direction toward mounting part 3, the motor 9 is engaged via contact 14 and the motor shaft 24 placed in rotation or oscillation around axis 19. This rotation is transferred by blades 25 and longitudinal studs 26 to the drive shaft 16, as well as to the connected cleaning tool 101. The cleaning shaft 102 having the bent part 36 is placed in rotation or oscillation around its longitudinal center axis because of this. At the same time, with movement of switch 13 into the on position, the drive shaft 16 is shifted outward via the annular strip 23 and annular groove 22 in the direction of axis 19. This movement is conveyed to the cleaning tool 101 connected to drive shaft 16, so that this is moved with switching of cleaning device 1 into the working position 41. The cleaning tool with end section 105 then protrudes from the guide sleeve 7 and can be used to clean the tooth surfaces. The guide sleeve 7, with the tooth cleaning device switched off, is advantageously initially positioned on the spaces between teeth being cleaned and only then is switch 13 moved to the on position. On this account, insertion of the end section 105 of the cleaning tool 101 is significantly facilitated. If switch 13 is released again by the user, spring 27 transfers switch 13 into the off position. This means that the cleaning tool 101 is also automatically retracted into the storage position 40. Contact 14 then no longer is in contact with motor 19, so that this is switched off.

The mounting part 3 and the receiving sleeve 136 are shown, together with the cleaning tool 101, in a transport position 43 in Figure 4. For this purpose, the receiving sleeve 136 has an inward protruding annular strip 38 roughly in the center in the coupling section 137. The base 128 of the cleaning tool 101 is provided with an annular groove 39 adapted to annular strip 38. In the depicted transport position 43 the annular strip 38 is snapped into the annular groove 39 and the

cleaning tool 101 is releasably fastened in the receiving sleeve 136. In this transport position 43 the mounting part 3 or the receiving sleeve 136 is commercially available as a replaceable part, for example, enclosed by a blister package, and can be purchased by the customer to replace worn cleaning tools 101. The cleaning tool 101 is safely accommodated and protected in the mounting part 3. If the mounting part 3 is positioned with the snapped-in cleaning tool 101 onto handle part 2, the pin 129 is introduced to hole 31. Just before the mounting part 3 is fully mounted on the handle part, the annular strip 38 is forced out of the annular groove 39, so that the cleaning tool 101 is now no longer fastened in the mounting part 3, but is arranged moveable in it.

Figure 2 shows a first practical example of a cleaning tool 101, in which the cleaning shaft 102 is held on a mounting section 6. The cleaning shaft 102 then has an intermediate section 133 on the mounting section 6 with several, especially uniformly distributed enlargements 134. An end section 105 is connected to the intermediate section 133. This end section 105 has two adjacent bent parts 130, 132 that form an eyelet 106. An insertion section 131 is connected to the bent parts 130, 132. Except for bent parts 130, 132, the cleaning tool 101 is designed essentially rotationally symmetric to a shaft longitudinal center axis 135. The cleaning tool 101 consists of a flexible plastic, for example, Hytrel, which is capable of withstanding the high alternating bending stresses without material fatigue phenomena.

In contrast, Figure 3 shows a cleaning tool 101 that has only a single bent part 130, which forms a ÒhalfÓ eyelet 106 in practice. By oscillation or rotation of the cleaning tool 101 around its shaft longitudinal center axis 135, the eyelet of the practical example of Figure 2 is dynamically completed, so to speak. The cleaning tool 101 according to the practical example of Figure 3 advantageously has simpler manufacture. This is understandable, in particular, if one considers that the thickness of the cleaning tool 101 in the region of the free end section is on the order of about 0.3 mm, in which the bent part 130, 132 has a value of about 0.5 mm $\pm$ 0.2 mm.

The end section 105 of a cleaning tool 101 according to Figure 2 is shown in Figure 6 enlarged. Two cleaning edges 112, 113 extend over the entire length of the cleaning eyelet 106, and especially over the insertion section 131. According to Figures 7 and 8, the cleaning edges 112, 113 are formed by incisions, so that blade-like studs 115 are formed. The incisions 114 are then arranged so that the studs 115 point in the same direction of rotation. The bent parts 130, 132 have an essentially triangular profile, whereas the insertion section 131 has a roughly square profile.

As can be gleaned, in particular, from Figure 5, the spherical enlargements 134 on the

intermediate section 133 of cleaning tool 101 serve as bearings to reduce sliding friction in the guide sleeve 7, since only linear contact occurs between the cleaning tool 101 and the guide sleeve 7.

[*See original patent for English claims and figures Ñ TranslatorÕs note.*]

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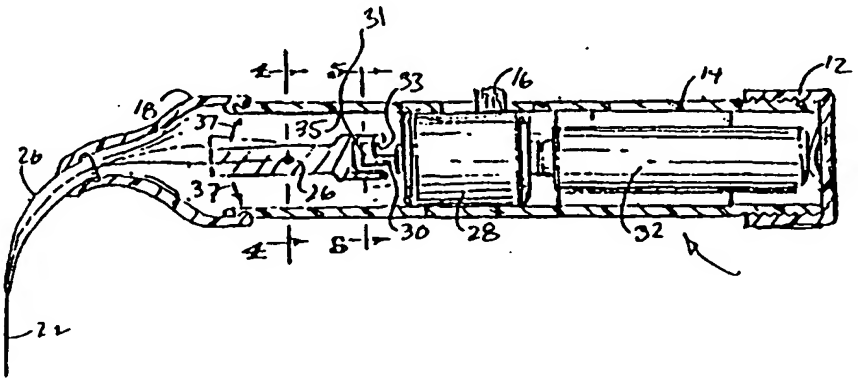

(57) Abstract

An electro-mechanical dental flossing device (10) is disclosed for flossing the area between a portion of the tooth and the gum tissue. The device comprises an elongated member (22) coupled to a motor source (28) to effect oscillation of the elongated member. The elongated member (22) includes an intermediate portion (23) and a tip (25) which are capable of being received between the tooth and the gum tissue.

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